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Edgar R Cataxinos
Trask Britt & Rossa
PO Box 2550
Salt Lake City, UT 84110

EXAMINER

QUACH, TUAN N

ART UNIT

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Please find below and/or attached an Office communication concerning this application or proceeding.



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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Paper No. 24

Application Number: 09/506,204
Filing Date: February 17, 2000
Appellant(s): DOAN, TRUNG T.

Edgar R. Cataxinos
For Appellant

EXAMINER'S ANSWER

MAILED

APR 09 2003

GROUP 2800

This is in response to the appeal brief filed November 14, 2002.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 1-44 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7). The brief states that claims 1-44 stand or fall together (page 4).

(8) *Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

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4,941,032

KOBAYASHI ET AL.

7-1990

(KOBAYASHI)

(10) *Grounds of Rejection*

The following ground(s) of rejection are applicable to the appealed claims:

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-44 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Saran taken with Kobayashi.

Saran shows the aluminum contact in contact holes in an insulating layer. See Figs. 1B and 2B, column 2 line 2 to column 3 line 20. Note that for product-by-process claims, it is the patentability of the product claims which must be determined. Thus Saran et al. lacks the recitation of the advantages of inclusion of the alloy, the recitation of the homogeneous alloy, and the various alloying elements.

Kobayashi teaches the use of electrode containing Al as the primary component and the inclusion of additional component where formation of homogeneous Al alloy, e.g., Cu, Mg, Zn, Ag, Ni, is also taught. The advantage of improved heat resistance and the prevention of metal diffusion into the semiconductor material is also delineated. See column 1 line 10 to column 3 line 42, column 4 lines 31-63.

It would have been obvious to one skilled in the art at the time the invention was made in practicing the Saran invention to have included the aluminum material a desired alloy as taught by Kobayashi wherein the homogeneous aluminum alloys can be obtained. Any alternative alloy materials not recited otherwise would have been

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obvious or alternatively, official notice is given regarding such use to obtain the desired alloy having improved heat resistance and reduced diffusion given the teachings of the references as delineated.

Regarding the recitation concerning "void free" feature in the preamble of claim 1, line 1, or in claim 23 last line, claim 39 last line, to the extent such recitation could be argued to impart any patentability to the claims, such would have been met or otherwise obvious, absent evidence to the contrary, as shown in Saran, Figs. 1B and 2B, column 2 line 2 to column 3 line 20.

The non-deformed aluminum bridge is clearly met by Saran as shown in Fig. 2B wherein no deformation is shown. In addition, such is met as shown in Saran, column 1 line 50 to column 2 line 3. The direct contact would have been obvious given that barrier while may be included is not required, e.g., Saran, column 3 lines 8-10.

Applicant's argument filed February 26, 2002 have been fully considered but they are not persuasive.

Applicant argues that all the claimed limitations must be met. Nonetheless, although the process is recited, applicant ultimately claims a product. See, e.g., claim 1 lines 1-3. It is well-settled that for product-by-process claims, it is the patentability of the product, and not that of the process, which must be determined. It remains apparent that the product features do not distinguish over that shown in the prior art. In particular, the void-free aluminum filled contact holes are clearly shown in the prior art. Kobayashi teaches the use of electrode containing Al as the primary component and the inclusion of additional component where formation of homogeneous Al alloy, e.g. Cu,

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Mg, Zn, Ag, Ni, is also taught. Furthermore, the non-deformed aluminum bridge is clearly met by Saran as shown in Fig. 2B wherein no deformation is shown. In addition, such is met as shown in Saran, column 1 line 50 to column 2 line 3. The direct contact would have been obvious given that barrier while may be included is not required, e.g., Saran column 3 lines 8-10. Furthermore, to the extent such is deposited by sputtering, such correspond to well known processing in the art as evidenced by Saran, column 3 lines 19-20. As the product in the product-by-process claim is the same or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 227 USPQ 964, 966. As delineated above, applicant ultimately claims a product which is the same or similar or obvious over that the prior art and applicant has failed to show any unobvious difference between applicant's product and that of the prior art. In re Marosi, 218 USPQ 289, 292 (Fed. Cir. 1983).

(11) Response to Argument

Appellant primarily argues (Brief page 5 last paragraph) that the combined references do not teach a completely filled aluminum alloy (i.e., void-free), homogeneous aluminum alloy in direct contact with a substrate, and having a non-deformed aluminum bridge over the contact holes, e.g., as recited in instant claim 1, lines 1-3. Appellant also argues that the instant product as created by the recited process resulted in a different product from that of Saran.

Initially, the product claims on appeal correspond to product-by-process claims. It is well settled that for product-by-process claims, it is the patentability of the product

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claimed and not of the recited process steps which must be established. In re Brown, 173 USPQ 685, 688. Furthermore, to the extent the product in the product-by-process claim is the same or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. In re Thorpe, 227 USPQ 964, 966.

With regard to the void-free recitation such would be met or otherwise rendered obvious over Saran which clearly shows the void-free aluminum contact, e.g., Figs. 1B and 2B wherein the aluminum material 30 and 60 fill the voids 20 and 50, see the abstract, column 2 lines 25 to column 3 line 4, column 1 line 48-49. As the consistent showing establishes: there is a void in instant Fig. 1A and in Figs. 1A and 2A of Saran, the obviation of such void as shown in instant Figs. 2 and 3 is shown similarly in Figs. 1B and 2B of Saran. Indeed, such void-free obviation would be consistent with applicant's admission and disclosure, as shown in instant Fig. 2.

The non-deformed aluminum bridge is further apparent in Figs. 1B and 2B in Saran wherein no deformation is shown. The non-deformed surface of the contact layer is clearly shown therein. Appellant has failed to show that the product in Saran is not completely filled or void-free, and that the product in Saran is not non-deformed. Furthermore, problem with deformed surface of the aluminum would be obviated since Saran employs a surface coating which serves to minimize shear forces exerted as delineated in Saran, column 1 line 50 to column 2 line 3, column 3 line 35-46. The objective of completely filling the contact hole and of eliminating undesirable effects of the high pressure force-fill process to the fill metal. The alleged deformed surface in the

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instant Fig. 2, has been considered. The fact remains that the invention of Saran has the objective of completely filling the contact holes (column 1 lines 47-50) and further employs additional protection layers 62/64 on the surface. In this regard, it is pointed out that the problem regarding the crack or splits in the metal film surface when exposed to the force-fill process is documented by Saran, column 1 lines 15-28 and wherein the contact in Saran would obviate problems with the surface of such filling metal. It remains that the problem with the surface as pointed out in the instant Fig. 2 would be overcome by the teachings of Saran wherein the top surface is protected with layers 62/64 during the forced-fill and appellant has failed to show otherwise.

It is further pointed out that the patentability of the structure in the instant application relates to negative recitation in claim language regarding problems, such as "void-free" or "non-deformed", namely the absence of some undesirable characteristics. Appellant nonetheless has failed to meet its burden to show that such negative characteristics are required in the prior art which show similar and conventional contact structures wherein no void is shown or required, wherein no surface deformation is shown or required or apparent. The burden is on appellant which has failed to meet.

With regard to the issue of the aluminum contact in the contact openings to a substrate, Saran is not limited to vias and indeed is applicable to both contact openings where contact is made directly to a substrate and to via openings wherein the plug material is made between metal levels. See column 1 line 52. See also the title, column 1 lines 8 and 48, column 3 lines 40 and 59, and column 4 line 46. The instant application similarly encompasses such contact openings and vias; see, e.g., page 4

last line, page 6 last two lines, page 7 line 6-7. Applicant thus has failed to show any evidence of non-obviousness with regard to such contribution and such remains apparent and obvious to one skilled in the art.

Furthermore, the "direct contact" language (which nowhere is defined or characterized in the original disclosure), to the extent that such language is to be interpreted as a contact to the substrate without any intervening barrier/adhesion material, such would have been conventional and obvious as the barrier may be included is not required; see column 3 lines 8-10. This is further readily apparent and corresponds to an obvious alternative in Saran, see e.g., claim 1 of Saran, column 3 line 59 et seq., which does not recite any or require any barrier/adhesion in the contact or /via openings and claim 3 of Saran,, column 4 lines 46 et seq., which recites the barrier in the contact or via openings. Furthermore, that such barrier would not be required is consistent with the original disclosure on page 8, wherein it was admitted that deposition of aluminum by sputtering eliminates the need for deposition of TiN. The deposition of aluminum by sputtering is notoriously conventional and indeed is employed in Saran, column 3 lines 19-20. It remains that such direct contact to a substrate is well known and corresponds to an obvious alternative well known to one skilled in the art as amply demonstrated in Saran.

Appellant argues that Saran does not disclose in a single embodiment the void-free contact without the barrier. This fails to consider the fact that the void is obviated by the forced fill process where the conductive material is forced into the contact openings. Indeed, such void-free is admitted in instant Fig. 2 and is employed in Saran,

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e.g., column 2 lines 45-48. It remains that such contact in Saran would not result in any void and appellant has failed to meet its burden to show otherwise.

Appellant further argues that Kobayashi cannot be combined with Saran because Kobayashi fails to teach using aluminum alloy within contact openings. This however fails to consider the teachings of Saran, column 3 lines 16-20, wherein filling openings with aluminum alloy is clearly taught. The advantages in terms of improved electromigration reliability and enhanced conductivity. It remains apparent to one skilled in the art that such aluminum alloy contact which fills openings is well known as shown in Saran. In this regard, it is pointed out that the aluminum alloy employed in Saran is nowhere precluded from being homogeneous. In any event, such homogeneous aluminum alloys are conventional as amply taught by Kobayashi including the inclusion of various enumerated alloy materials, e.g., nickel, copper, zinc, tin, is clearly taught in Kobayashi. Kobayashi is applicable to semiconductor devices and clearly analogous and does not teach away from the instant invention which also corresponds to semiconductor devices and indeed also employs aluminum alloy electrode contacts to semiconductor substrates. Contrary to appellant's argument, the prior art clearly teach the combination, rather than teaching away from the combination as alleged. Furthermore, the use of homogeneous aluminum alloy is clearly conventional and advantageous as demonstrated by Kobayashi, wherein increased electrical resistance can be obviated and wherein improved heat resistance can be obtained. Additional advantages include the prevention of diffusion of the element of metal electrode into the semiconductor layer during the production and use of the semiconductor device.

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In conclusion, it is respectfully submitted that all the evidence of obviousness and non-obviousness have been carefully considered and the evidence of obviousness clearly outweigh the evidence of non-obviousness.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Conferees

Olik Chaudhuri *OC*

Wael Fahmy *Wf*



Tuan Quach
Primary Examiner

Edgar R Cataxinos
Trask Britt & Rossa
PO Box 2550
Salt Lake City, UT 84110